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BOOK REVIEWS

AIR POLLUTION AND FORESTS: INTERACTIONS BETWEEN AIR CONTAMINANTS AND FOREST ECOSYSTEMS, by W. H. Smith, with pp. xv + 379 and 60 figures. ISBN 3–540–90501–4. Berlin, Heidelberg, New York: Springer-Verlag, 1981. SPRINGER SERIES ON ENVIRONMENTAL MANAGEMENT. DM 64, approx. US $ 30,50.

An understanding of the influence of the ever-increasing variety of air contaminants on the many components and processes of the forest is essential to our appreciation of the complex interactions between air pollutants and forest ecosystems. W. H. Smith presents a comprehensive documentation and review of research regarding these interactions.

In this informative book, the most significant relationships between forests and air pollution are highlighted for low, intermediate and high pollutant dose conditions. On this basis of dosage, a concept first proposed by the author in 1974, three classes of interactions are distinguished: Class I, Class II and Class III. These three classes provide the three sections of the text, covering (I) the function of forests as both sources and sinks for air pollutants, (II) the stresses caused to forest processes in a subtle manner, and (III) the dramatic influences on forest ecosystems.

Starting from the introductory pages, the reader is presented with a wealth of information which is clear, concise and interesting. This publication is also orderly: definitions are given for the terms, air pollution and ecosystem, before one reaches page three, by which stage primary and secondary air quality standards (for the United States) have been detailed and the range of materials which pollute the troposphere tabulated.

The role of forests is discussed with regard to the major element cycles: carbon, sulphur and nitrogen. Traditional models are reviewed together with new hypotheses. Estimates of global nutrients budgets however, are incomplete, and the author warns that predictions must be treated with caution.

Forests are known to be important sources of volatile hydrocarbons and particulates. Forest fires too, contribute to the pollutant load of the atmosphere.

The sink function of forests is detailed (60 pages) and concerns both the soil component and vegetation of forest systems. Trace elements, especially lead in roadside ecosystems, are important contaminants; other significant particulates include pollen and dusts. Gaseous pollutants such as carbon monoxide and sulphur dioxide can be transferred from the atmosphere to the soil by microbial mechanisms, while uptake of sulphur dioxide and oxidants by vegetation involves air flow and diffusion processes.

Ample evidence is given in support of the hypotheses that forest systems are important sources and sinks of air contaminants under conditions of low pollution dosage (Class I interactions). Additionally, consequences of these functions are assessed.

Class II relationships (intermediate doses of air pollutants) are primarily based on extrapolation from controlled laboratory and greenhouse experiments. The significance of Class II interactions is enormous, for direct or indirect physiological changes occur in individuals of the ecosystem which, in turn, may be severely affected. As Class II interactions may occur at pollution dosages approximating present ambient levels (in temperate forest areas), these relationships must be considered to be of great importance.

In 189 pages of text, figures, tables and references, evidence is presented of alterations in forest tree reproduction, forest nutrient cycling, tree metabolism, susceptibility to disease and insect pests, and symptomatic foliar injury caused by a range of air contaminants. Aspects covered in this section include pollen germination, organic matter decomposition, acid precipitation and leaching, nitrogen fixation, photosynthesis, phytophagous insects, plant pathogens, and acute foliar disease.

Resultant ecosystem impacts would be shown as reduced growth and thus, reduced biomass. Differential tolerance to air pollutants at the species level may be reflected at the ecosystem level as sustained alteration of reproductive potential, or competitive advantage of one species, leading ultimately to changes in succession and species composition of the community. In assessing the importance of these ecosystem changes, the author, of the School of Forestry and Environmental Studies at Yale University, calls for the establishment of comprehensive investigations to systematically examine Class II interactions in forest ecosystems subject to air pollution stress.

Class III relationships have been documented directly in the field since high pollutant dosages do occur in temperate forest regions adjacent to industrial, power generating or urban establishments. Extensive injury to vegetation may be caused by high pollution loads and is characterised by severe morbidity and mortality: trees may be badly injured or killed.

A number of examples of significant pollutant damage are given for air pollution episodes involving sulphur dioxide and fluorides. Knowledge is limited however, regarding the influence of oxidants on forest systems. Impact on ecosystems generally is acute and results in changes in species composition, reduced biomass, increased erodibility, and forest simplification. Although Class III interactions are the most dramatic of all responses, the actual forest areas involved are less extensive than in the Class I and Class II interactions.

The relative importance of specific air pollutants to forest ecosystems is discussed in the final chapter, with comments on the anticipated trends in emissions from anthropogenic sources over the next decade. The author predicts (for the United States) that increases will occur in emissions of carbon dioxide, sulphur dioxide, nitrogen oxides and particulates. He concludes that air pollution "has the potential to cause significant reductions in forest productivity and shifts in species composition in numerous areas throughout the temperate zone".

In presenting this review of the research involving air pollution and forests, W. H. Smith has produced an authoritative book of remarkable thoroughness. Concepts and hypotheses are clearly stated and the relevant authors cited: the reference section at the end of *each* chapter provides an outstanding selection of literature sources. Useful tabulations appear liberally throughout the text and 60 figures annotate the 379 pages. Typographically the text is accurate and visually well designed.

A criticism can be directed at the Index which is only just adequate; however, together with the very detailed listing of chapter contents given at the beginning of the book, one can readily locate the desired subject. Although the documentation is specifically intended to deal with forest ecosystems, nevertheless it is surprising that reference is not made to the extensive work carried out on lichens as indicators of air pollution.

Data detailed in this book relate to the temperate latitudes of the Northern Hemisphere. No South African species are mentioned; however, the research reviewed provides an invaluable base for interpreting the complex relationships between air pollutants and forest ecosystems in other regions.

This book is not intended for the layman, but is one in a series to be published by Springer-Verlag, "dedicated to serving the growing community of scholars and practitioners concerned with the principles and applications of environmental management". *Air Pollution and Forests* can be highly recommended to all persons involved in environmental matters, either from the aspect of air pollution, agriculture, afforestation, or management and function of terrestrial ecosystems.

E. R. Ashton

Plant Science: an Introduction to World Crops, edited by J. Janick, R. W. Schery, F. W. Woods and V. W. Ruttan, with pp. 868 and 520 figures. 3rd ed. ISBN 0–7167–1261–X. San Francisco: W. H. Freeman, 1981. Board £15,60.

Earth is a planet dominated by plants which serve, not only the human race but the entire living world, for many of its needs. An adequate food supply, both for domestic use and for export to less fortunate countries, remains of paramount importance. Greater and more intensive production of food and many other plant products must inevitably rate as priority number one in all civilised countries. Increasing knowledge of the three necessities of life–food, clothing and shelter—and the many other uses of plant products cannot fail to broaden one's outlook.

This book, the third edition, was written to give students the scientific, technological and economic foundations of world crop production. The sciences dealing with plants and the technology and economics of crop production and marketing have become irrevocably entwined. Each contributes relevance and meaning to the other. Although the text was planned for use primarily as an introductory, university-level course in plant science, crop science or economic botany, it is also highly recommended for use by anybody interested in this fascinating subject.

Part One, *Plants and People*, introduces the relationship between crops and civilisation in both historical and biological terms.

Part Two, *Nature of Crop Plants*, is a formal presentation of plant relationships, structure and development.

Part Three, *Plant Environment*, is an introduction to the ecology of crop plants.

Part Four, *Strategy of Crop Production*, features technological aspects of agricultural practices.

Part Five, *Industry of Plant Agriculture*, surveys individual crop species.

Finally Part Six, *The Marketplace*, explores the relation between crops and the economic community.

The authors must be congratulated on an excellent book, well illustrated and with a wide range of interesting and modern facts—a welcome addition to our literature in this field.

Any person or university seriously interested in varying aspects of Economic Botany, should add this volume to their bookshelves.

K. J. Pienaar

MORPHOLOGIE DER BLÜTEN UND DER BLÜTENSTÄNDE, by F. Weberling, with pp. 391 and 193 figures. ISBN 3–8001–3426–8. Stuttgart: Eugen Ulmer, 1981. DM 108.

This immaculately produced book has clear illustrations some of which are photographs, others black and white diagrams and line drawings. Twenty pages of references together with extensive indices to plant names and subjects (including terminology) contribute to a useful reference book.

The layout would suit lecturers for graduate courses in the morphology and development of flowers, inflorescences and floral biology; the main sections into which the book has been divided. It will be equally useful as a reference to plant morphology.

1. *Morphology of Flowers:* The wide scope ranges from floral diagrams to bud initiation, floral axes, as well as the histogenesis and morphology of individual floral parts including structures such as the floral cup and hypanthium. Many modifications and specialisations of floral parts, such as polyandric androecia, petaloid staminodes, placentations, false septa and various types of nectaries, are just a few of the diverse phenomena discussed. The whole book is restricted to factual data and currently accepted concepts and does not enter into controversial hypotheses on, for example, the evolutionary origin of particular organs.

2. *Morphology of Inflorescences:* The definitions and delimitations of inflorescences immediately indicate that the author employed only Troll's system of classifying inflorescences, which despite being largely a new approach includes many conventional concepts. The uninitiated might find this at first perplexing but will soon realise that its more precise terms allow one to better discriminate between a wide range of forms often previously included in one form of an inflorescence. Its more detailed terminology allows more meaningful comparisons of inflorescences and the evolution of different taxa. The condensed presentation allows an easier insight and overview of the system than the existing two volumes of the series envisaged by Troll but, unfortunately, never completed. Detailed diagrams and illustrations are valuable aids in the discussion of often complex structures. It can only be hoped that this summary will promote the use of Troll's system which is a valuable tool in comparative morphology and taxonomy and help establish its terminology.

3. *The Flower as a Structural and functional Unit in Aspects of pollination and dispersal Biology:* The much shorter final part then places the morphology into biological perspective, mainly in reference to pollination. Various syndromes and concepts such as cross pollination, self-incompatability, herkogamy and dichogamy are considered as well as the morphology of various flowers considered typical of wind, water and animal pollination. This is followed by fruit classification and dispersal; the fruit being considered as a flower at the stage of maturity of the seeds. Although this might seem contrary to the title of the book it enriches the usefulness of this fundamental reference book.

The extremely condensed style is similar to the widely used "Strassburger" but here the advanced student and researcher is also provided with a wide range of references.

H. R. TÖLKEN

Ascomycete Systematics: the Luttrellian Concept, edited by D. R. Reynolds, with pp. ix + 242 and 122 figs. ISBN 3–540–90488–3. Berlin, Heidelberg, New York: Springer-Verlag, 1981. Cloth DM 79, approx. US $41,50.

This further contribution to the *Springer Series in Microbiology* (editor: M. P. Starr) is a report on the application of the Luttrellian concept to fungal systematics by some of the most eminent authorities in the field of ascomycetology. This book assesses the progress of Luttrell's approach (". . . an emphasis on the relationship between the ascus and the totality of ascocarp components") and the utilization of this concept with regard to fungal groups where different taxonomic systems have traditionally been used.

In the first part of this volume (the ascus) the form and function of the ascus is emphasized. The ascus that produces a specialized pore in the apex through which the ascospores are discharged is analysed; the discomycetous ascus with an operculum is discussed; the basic concept of the bitunicate ascus is evaluated; and the ascus in a group of fungi similar to the discomycetous ascomycetes, the lichenized species in the order Lecanorales, is reviewed.

In the second part of the volume (the centrum) the authors take the attitude that the Luttrellian concept can be applied to ascomycete groups where the centrum character is not normally utilized. The plectomycete centrum is defined and elaborated upon; a centrum is considered as a possibility in discomycetous fungi; the centrum approach is taken in the lichenized ascomycetes placed in the order Lecanorales; and fungi with a pyrenomycete centrum are reviewed according to whether the component ascus is unitunicate within a non-lichenized or a lichenized ascocarp. Finally, the classic centrum containing the bitunicate ascus is considered by E. S. Luttrell himself.

The book is very well written and the quality of production is excellent. The line drawings and black and white photographs effectively cover the important aspects of the structure and ultrastructure of the ascocarp and ascus. References for each chapter are grouped at the end of the chapter and seem to be quite adequate. This book would be of benefit to undergraduates and postgraduates having the necessary background. It can be thoroughly recommended to practising Mycologists and research workers.

Albert Eicker

A Field Guide to the Trees of Southern Africa, by Eve Palmer, with pp. 393, 32 colour plates and 700 line drawings. 2nd ed. 190 × 125 mm. London and Johannesburg: Collins. Hardcover R15,95.

This book, by the author of a comprehensive three volume reference work on trees of Southern Africa, is intended as a field guide to all the tree genera of Southern Africa, excluding Mozambique, and includes some 980 indigenous and some 50 naturalised species. The keys are based essentially on vegetative characteristics, namely leaves—with flowers, fruits, bark, habit and habitat data being used as unimportant extra aids to identification and for information. In addition, many of the species are illustrated with line drawings, by Rhona Collett.

The contents include some useful guidelines on how to use the book, and there is a fairly comprehensive illustrated glossary to aid those troubled by botanical nomenclature. Then follows some 37 pages of partly illustrated keys to groups (and genera).

The main bulk of the text comprises descriptions of the more common, and some rare species with keys to species in the bigger genera like *Acacia, Rhus, Maytenus,* etc. This part of the text has numerous line drawings in which the artist has made a commendable effort at capturing those important and/or diagnostic specific characters. Finally the national list of indigenous South African trees produced by the Botanical Research Institute is included for ready reference to numbered trees that the reader may find in the field. There is also a selected bibliography and separate indices to African names and a general index to English, Afrikaans and scientific names.

I feel that an important general omission from the book is the lack of distribution maps, and that the "scale line" is not always present on the sketches (especially in the key). Also, not all the nomenclature is up-to-date (e.g. *Celtis durandii* is now *C. gomphophylla* and *Olea africana* is *O. europaea* subsp. *africana*). There are some spelling mistakes (e.g. *Chaetachme* should be *Chaetacme*), and there are rather too many typographical errors such as the omission of *NOT* in the all important key to groups (page 26 *Group 8* Leaves alternate, margin entire—should be margin *not* entire) and errors on page 335.

Despite some of the shortcomings this toughly bound guide provides much useful information to the layman and botanist alike. I would certainly strongly recommend that anyone seriously interested in tree identification in southern Africa should consider this book for their library.

E. J. MOLL

THE VEGETATION OF AUSTRALIA, by Noel C. W. Beadle, with pp. xxvii + 690, 416 figures and 91 tables. ISBN 0–521–24195–2. Cambridge: Cambridge University Press, 1981. £50.00.

Prof. Noel Beadle's *Vegetation of Australia* is the first publication to attempt a modern descriptive survey of the vegetation of that vast continent. Drawing on his own work and that of others, the author has bravely attempted to sort a vast array of data into a reasonably comprehensive synthesis of Australian vegetation types. This is summed up in a vegetation map which identifies 90 major plant alliances.

Those of us in South Africa familiar with Acocks' "Veld Types" will find Beadle's monochrome map with its rather complicated symbols, a little diffuse. For example, the boundaries between vegetation alliances are not always clear, especially in Central Australia, where (presumably due to incomplete data) the situation is rather confused. But despite these reservations, when one considers the awesome size of the landmass Beadle is dealing with, one can only be lost in admiration at what he has achieved.

The initial 130 pages of this book serve as an introduction by discussing general aspects of Australian vegetation; the Australian environment, climate, soil types; the flora, its origin and evolution; while the remainder of the book is devoted to descriptive accounts of Australian plant communities. These range from rain forests through the ubiquitous *Eucalyptus* communities, to heathlands, deserts and even sea grasses and marine meadows. Naturally, pride of place goes to the *Eucalyptus* communities which account for eight chapters and nearly one-third of the whole book. Throughout this work Beadle uses the association as his basic vegetation unit—defined as a community in which the dominant stratum exhibits uniform floristic composition; the community usually exhibiting uniform structure.

The author has been very generous with his photographs. There must be at least one on every page. What is more, they are exceptionally clear and very well reproduced. Indeed, they convey most graphically the structure and texture of the communities under discussion. A high grade glossy paper is used throughout which gives the whole book a stamp of quality. It is therefore rather disappointing to see so many typographical errors, especially where binomials are used; e.g. *Disphania australe* (p. 494) and *Disphymia australe* (p. 603) are just two variations on what is correctly reported as *Disphyma australe* elsewhere.

A generous reference list and index complete the text.

This is obviously a work of great importance to Australian botanists and of considerable interest to others, especially in southern hemisphere countries where similar alliances, like heathlands for example, are also found. It will clearly remain the definitive text on Australian vegetation for some time. Producing a pioneering work is often a thankless task. This one must have been particularly difficult but in the end Prof. Beadle has given us a highly informative work which is also a pleasure to use and to read. It made me want to learn much more about Australian vegetation.

J. P. ROURKE

AUSTRALIAN VEGETATION, edited by R. H. Groves, with pp. xiv + 449, 58 figures and 33 tables. 235 × 160 mm. Cambridge: Cambridge University Press, 1981. Hardcover £27,50.

Richard Groves, of the C.S.I.R.O. Division of Plant Industry in Canberra, who has edited the eighteen chapters which comprise this book, is well known for his ecological work on heathlands and grasslands in particular. For the present volume he has obtained specialist contributions from twenty-two authors and co-authors and has done well to maintain a reasonably uniform and easy style of presentation throughout.

The contents of this book are conveniently structured into four major sections. Chapters one to three are introductory chapters which set the scene for the main body of the text, and include the phytogeographic setting for the Australian floristic kingdom, some important items on the vegetation history, and a section on alien plants. The treatment of the major vegetation types then follows with chapters on the various forest, woodland, shrubland, heathland and grassland components. There are then four chapters on the vegetation types of extreme habitats which include mangroves and salt marshes, fresh water wetlands, alpha and sub-alpine vegetation and desert communities. Finally there is a last chapter on the conservation of vegetation types followed by an author index, an index to scientific names and a subject index.

This book, which will appeal to all those seriously interested in Australian vegetation, is aimed at undergraduates and post-graduates, and has a nice balance between text and illustrative material.

Perhaps more community photographs could have been added as well as a specific chapter on coastal dune systems in the section on vegetation of extreme habitats. Also, since strip and open-cast mining has caused great concern to conservationists, and considerable research has been done on re-vegetation programmes in Australia, a special chapter on this aspect should perhaps have been included.

I would strongly recommend this book as an introductory text to the vegetation of Australia. Since we in South Africa share much in common with this southern continent the text is relevant to local students and is certainly a must for libraries and Departments of Botany of our Universities.

E. J. MOLL

ZUR FEINSTRUKTUR, CHEMIE UND TAXONOMISCHEN SIGNIFIKANZ EPICUTICULARER WACHSE UND ÄHNLICHER SEKRETE, by Wilhelm Barthlott and Eckhard Wollenweber. Wiesbaden: Franz Steiner Verlag GmbH (Tropische und subtropische Pflanzenwelt 32, 1981). DM 24,80.

The overall appearance and lay-out of this handy, softcover booklet of 67 pp. is good although the double pagination is somewhat confusing. The contents is logically arranged into the following chapters:

1. *Introduction*—which gives a good literature survey.
2. *Material and methods:* The authors recommend amongst other things the use of relatively young, fresh plant organs or *air dried* herbarium material. Critical-Point-Drying and dehydration methods should be avoided.
3. *Micromorphology of the epicuticular secretions:* These secretions are classified into 7 types, i.e. continuous layers with (1) smooth surfaces, or (2) sculptured surfaces and predominantly crystalloid "projections" namely (3) irregular particles; (4) simple rodlets to threads; (5) simple flakes; (6) compound rodlets, threads and flakes composed of sub-units; and (7) rodlets to threads with microcrystalline surfaces.
4. *Chemistry of the waxes and related secretions:* The secretions consist of alkanes, long-chain alcohols, ketones and esters of long-chain fatty acids (true waxes). Pentacyclic triterpenes and phytosterols are more abundant than known previously, as are epicuticular flavonoids which are usually secreted by specialised glandular trichomes.
5. *Morphogenesis and relation between fine structure and the chemistry of the epicuticular secretions:* The comprehension of the structural diversity and the distribution pattern of these secretions gives the reader insight into the morphogenesis. The authors point out that the relationship between the chemistry and fine structure is still largely unknown although some trends can be recognised.
6. *Taxon specific distribution patterns.*
7. *Influence of environment and age on the fine structure of epicuticular waxes and related secretions:* The influence of the environmental factors on the micromorphology is limited. With age, the secretions may undergo an erosion and occasionally disappear completely.
8. *Ecological aspects of epicuticular secretions:* Epicuticular waxes have very different and partially very specialised functions, e.g. they act as a mechanism to control surface temperature under insolation.
9. *Taxonomic-systematic significance of epicuticular secretions:* The micromorphology and arrangement of especially the crystalloid secretions, proved to be a good taxonomic characteristic. The authors supply the taxonomists with a descriptive terminology and way to evaluate the systematic significance of these secretions.
10. *Summaries:* in English and German.

The index and bibliography are adequate. Unfortunately however, some references have been omitted, e.g. Frey-Wyssling, 1972 (mentioned on p. 8) and Hoch, 1979 (on p. 16).

The placing of the figures in the text, could have been more judicious, e.g. on pp. 7–10 no figures are being referred to, while on p. 11 figures 1–4 are inserted.

Reading the text, the attention is then drawn to figure 11 (p. 12) and thereafter to figure 37 (p. 16).

This publication should be very valuable for postgraduate students and research workers. It has a wide application for botanists in South Africa as the study of these secretions can be used as an additional taxonomic characteristic. South African material is mentioned specifically, e.g. on pp. 17 and 48.

The publication is a valuable contribution as it is the first comprehensive coverage of this topic. This review also covers original research by the authors on about 5 000 species of vascular plants. The price of about R11 is very reasonable.

I. von Teichman

Bromelienstudien 1. Neue und wenig bekannte Arten aus Peru und anderen Ländern, deur Werner Rauh, met pp. 28 + 9 figure. Wiesbaden: Franz Steiner Verlag GmbH (Tropische und subtropische Pflanzenwelt 33, 1981). DM 11,20.

Hierdie publikasie is die nuutste van 'n hele aantal publikasies van die outeur oor die onderwerp. Soos uit die subtitel afgelei kan word, word in die teks nuwe en skaars taksons in die familie Bromeliaceae beskryf. In hierdie publikasie word agt nuwe taksons deur die outeur beskryf. Die betrokke taksons ressorteer onder vier genusse, naamlik *Tillandsia, Vriesea, Guzmania* en *Pitcairnia*. In eersgenoemde genus word vier nuwe spesies, in die genus *Vriesea* twee, in die genus *Pitcairnia* een nuwe spesie beskryf. In die genus *Guzmania* word 'n nuwe variëteit beskryf.

Die beskrywings behels die latynse frase gepaardgaande met die verwysing na die holotipes en die verspreiding van die takson. Geen verspreidings kaarte word egter voorsien nie. Elkeen van die beskrywings is vergesel van foto's (in sommige gevalle twee, in ander gevalle drie) waardeur die onderskeidende kenmerke van die taksons duidelik geïllustreer word. Beskrywings van die taksons word ook in Duits voorsien.

Geeneen van die taksons wat beskryf word, word in Suid-Afrika aangetref nie en daarom is die publikasie vir die deursnee Suid-Afrikaanse plantkundige van relatief min belang. Vir taksonome in die familie Bromeliaceae en spesifiek die betrokke vier genusse, is die werk egter onontbeerlik.

Die publikasie is in Q formaat op duursame glanspapier gedruk en die foto's is van besondere hoë standaard.

P. D. F. Kok

Infloreszenstudien an Aizoaceaen, Mesembryanthemaceen und Tetragoniaceen, by Wilhelm Troll and Focko Weberling, with pp. 99 and 48 figures. ISBN 3-515-03422-6. Wiesbaden: Franz Steiner Verlag GmbH (Tropische und subtropische Pflanzenwelt 35, 1981). DM 36,20.

This unusual publication is part of a journal but can also be obtained as a book and has thus separate paginations at the top and bottom of each page. It represents a part of, and thus follows closely, the detailed discussion of families with cymose inflorescences started by Troll (1969) in *Die Infloreszenzen* vol. 2, part 1. The pr ent contribution which includes original research and reviews of representative cases in each family, was published in full, separately from other families to be included in that volume of Troll's series, because it had gone beyond the envisaged scope. It was primarily written for the researcher, but would serve equally well as an instructive demonstration of the uses and versatility of Troll's system of the morphology of infloresences or its taxonomic applications.

In all three families the thyrse is widely found. Each thyrse may consist of few to many dichasia with one or more flowers, depending on environmental conditions, as for instance shown in *Dorotheanthus gramineus*, or on the position, i.e. the upper or lower region of the plant, as in *Carpanthea pomeridiana*. In most cases, especially in these rosette plants, the bracts are leaf-like and have previously been regarded as leaves. The apparently axillary flowers, or at least the terminal branches of *Mesembryanthemum crystallinum*, are part of foliose monochasia, which are even more pronounced in the prostrate *Aizoon canariense* and *Aptenia cordifolia*, although here somewhat modified. Even the tufted *Delasperma cooperi* has a similar sympodial growth. An understanding of the variability of the inflorescences is needed to comprehend the complex reduction series which led ultimately to the two-leaved plants of *Conophytum* or *Lithops*. Variations on the theme, as found in *Fenestraria, Cheiridopsis* or *Mitrophyllum* make interesting reading well illustrated with diagrams and photographs.

The inflorescences of the family Tetragoniaceae tend to show a reduction in the number of flowers on lateral part-inflorescences but an increase in the number of them. This "bottle-brush-effect" is heightened by the tendency to loose the terminal flower, showing that determinate and indeterminate inflorescences, which were usually considered a basic difference, can occur in the same genus.

This book is written for the specialist or researcher but even he must be familiar with Troll's interpretations and terminology. An introductory chapter explains many of the abbreviations used while others are presumably self-explanatory, at least when used for the first time. When a researcher is, however, interested in just a part of the book he is placed in the awkward position of having to find a definition of, for instance HP, EP, CoT and GT, in Troll (1964). The book is thus not self-contained nor is it a research paper in a strict sense, where such knowledge could be presumed.

The literature references, 45 in all, show how neglected this subject has been when one considers that about 2 000 species occur in South Africa alone. The importance of this publication is, however, diminished by the unfortunate decision of the authors to publish the contribution referring to that part of the family which is now usually recognised as Molluginaceae at a later stage. In a group of families as closely related as these it would have much increased the usefulness of the comparison.

H. R. Tölken

Zur Morphologie und Anatomie der Gattung *Belonanthus* graebn. (Valerianaceae), by Dorothea and Focko Weberling, with pp. 41. Wiesbaden: Franz Steiner Verlag GmbH (Tropische und subtropische Pflanzenwelt 36, 1981). DM 14,20.

The publication deals with an unusual, small South American genus of Valerianaceae which occurs in the high Andes from S. Columbia to Bolivia. The authors concentrate their investigations on two species which they studied, fixed and collected in the field. They give detailed morphological descriptions of both the vegetative and generative regions, supplemented by well documented anatomical investigations. Floral morphology is studied in depth; gynodioecy is described for one species, and morphological differences between hermaphrodite and female flowers (smaller corollas!) are recorded. Pollen morphological descriptions and chromosome numbers are also given, although some of these data were, in part, previously published. Two other species are briefly discussed; the fifth species of *Belonanthus* is mentioned in the introduction but completely ignored in the subsequent chapters. *Belonanthus* is compared with other South American high mountain rosette forming genera of Valerianaceae, notably the closely allied genus *Phyllactis*, from which *Belonanthus* has been segregated. While differences and similarities between the two genera are pointed out in various parts of the text, it would, in the reviewer's opinion, have been desirable to more directly compare the two taxa (perhaps in tabular form?) and discuss their status in greater depth.

The volume, like all others in the series *Tropical and Subtropical Plantworld*, is lavishly produced and printed on glossy, high quality paper but, unfortunately, not enough care has gone into the preparation of the present article. Considering the relative brevity of the publication (41 pages, of which more than a third are figures), it is a bit disturbing that in "References" (19 are given) (a) one publication is not cited (Benoist, 1932), (b) four publications are cited to which no reference is made in the text, and (c) for another four citations, the year of publication does not, or only in part, correspond to that given in the text. Furthermore, no reference is made in the text to various figures, or an incorrect figure number is referred to; in some cases, individual photographs making up a figure are not labelled in accordance with the figure legend, and scales are often missing. Some figures, although of good technical quality, appear somewhat redundant.

The booklet, nevertheless, is a valuable contribution to our knowledge of one of the more unusual genera of Valerianaceae. Although of little immediate relevance to South African botany, it can be recommended to anyone interested in systematically oriented morphological and anatomical investigations.

CHRISTIAN PUFF

CELL WALLS '81. Proceedings of the Second Cell Wall Meeting held in Göttingen April 8–11, 1981, edited by D. G. Robinson and H. Quader, with pp. 297, 211 figures and 32 tables. ISBN 3-8047-0669-X. Stuttgart: Wissenschaftliche Verlagsgesellschaft MBH, 1981. Paperback DM 58.

This book is a rapid publication by the Wissenschaftliche Verlagsgesellschaft MBH, Stuttgart, in softcover, measuring 150 × 220 mm. It contains the full text of 31 of the 36 lectures which were delivered at the Göttingen meeting.

The text is divided into several sections, the number of papers per section is indicated in parentheses. Organelles and Cell Wall Synthesis (5), Glucan Structure and Synthesis (12), Microfibril Orientation and Microtubules (5), Hormones, Cell Walls and Elongation (4), and Free Themes (4).

The papers chosen for inclusion by the editors are absorbing and contain a great deal of valuable information. Aspects of cell wall structure covered in this text include examples from the higher plants, as well as the green algae. The illustrations are generally of good quality. Among the themes explored, the papers by Wessels and Sietsma, and that of Ferve, present new data on the regulation of Glucan Synthetase in cell wall growth.

A major drawback to this volume is the absence of an index. Further, the lack of uniformity of the reference citations would make follow-up literature reviews by research workers rather difficult—a few of the authors list references in full, including titles, others do not. In many instances, the references are presented in the form of continuous lists.

To sum up, *Cell Walls '81* contains a wealth of information on the ultrastructure and biochemistry of cell wall synthesis. Apart from the inconsistency of the literature citations, this text is an invaluable reference source, for researchers whose interests are centred around cell wall synthesis, differentiation, ultrastructure and biochemistry.

C. E. J. Botha

Preface to the reviews of the following six books dealing with *in vitro* culture techniques:

The fourth International Plant Tissue Culture (IAPTC) Congress was held in 1978 in Calgary, Canada and the fifth recently took place (July, 1982) in Tokyo, Japan. In the four years that have elapsed books on plant protoplast, cell and tissue culture have sprouted like mungbeans. In reviewing *Plant Cell Cultures: Results and Perspectives* (edited by F. Sala, B. Parisi, R. Cella and O. Ciferri) for TIBS (Trends in Biochemical Science), M. W. Fowler of the University of Sheffield expressed the conviction that not a great deal of progress had been made between the meetings in Canada and Italy. With this journal's characteristic satire the editor of TIBS captioned the review: "The stampede from Calgary to Pavia—was it too fast?" Fact is it was: not only to Pavia, but to some other conference centres and editorial offices as well. To ascertain the real progress the reader still has to rely on the professional journals, since most conference proceedings are already two years out of date by the time they are published.

PLANT CELL CULTURES: RESULTS AND PERSPECTIVES, edited by F. Sala, B. Parisi, R. Cella and O. Ciferri, with pp. xix + 433. ISBN 0–444–80204–5. Amsterdam, New York, Oxford: Elsevier/North Holland Biochemical Press, 1980. US $65.50.

The book represents the proceedings of an international conference held in Pavia, Italy in August 1979. The title, however, obscures the fact that in addition to cells a very large part of the contents were devoted to protoplasts, tissues, organs and plants. The book is divided into seven parts and provided with author and subject indices. The first part, "The problem, the state of the art and the perspectives" allows the authors to indulge in a little speculative biology. The term *art* tends only to underscore that much of tissue culture technology today still is empirical and comprises too much of what might be termed as hits and misses and happenings.

The organization of the remaining six parts contains elements of randomness. Under "Plant propagation through tissue culture", there are papers on riboflavin and roots, germplasm storage, and proliferation of protoplasts and cell cultures. Under "The contribution of classical genetics and of somatic cell genetics to plant improvement", one finds a consideration of growth and morphogenesis, and so forth. As a previous reviewer has pointed out, what is lacking is an introduction by the editors to each of the sections. This would have assisted the reader in obtaining a better grasp of the perspectives, instead of leaving the impression that cleverly-construed section headings are to be depended upon for orientation.

The quality of the papers are extremely varied and some are meaninglessly brief. The contents of a few are familiar from previous publications and the gist of others recall similar deliveries at the Calgary meeting a year earlier.

The vexing thing is that in spite of the limited number of relevant papers to any particular line of research and the high cost, this is a volume that the tissue culture worker would want in the laboratory, but it is a book for the institutional library and not for the individual. I am afraid, too, that the Pavia proceedings will remain overshadowed by those of both Calgary (1978) and Tokyo (1982).

C. H. BORNMAN

ADVANCES IN PROTOPLAST RESEARCH, edited by L. Fereczy and G. L. Farkas, with pp. ix + 511. ISBN 0–08–025528–0. Oxford, New York, Toronto, Sydney, Paris, Frankfurt: Pergamon Press Ltd., 1980.

This volume contains a selection of 59 contributions to the Vth International Protoplast Symposium, organised under the auspices of the Hungarian Academy of Sciences and held in Szeged in July 1979. The proceedings were published late in 1980, becoming generally available in 1981.

The symposium was intended to cover widely ranging aspects of bacterial, fungal and higher plant protoplast research, but the topic of greater interest was that of protoplast fusion. In fact 50 % of the papers embrace the word *fusion* in their titles.

It is easy to be critical in retrospect, but more difficult to be so as regards the proceedings of a conference, since these usually consist of a series of papers organised in sequential pattern by one or more editors. However, with the heavy emphasis on fusion, other—in some respects more important—problems were skimmed over by the Szeged symposium. One of these, as far as the higher plant is concerned, is regeneration of the entire plant from a protoplast. This, to date, has not been achieved in too many species, so that a title such as "Fusion of citrus and tobacco protoplasts—a new system for somatic hybridisation studies with remote species" becomes highly academic and just ever so slightly far-fetched.

We now know, again in retrospect, that in the intervening period (1979, 1980, 1981) there have been some advances in protoplast fusion using electrical fields, but systems for the reproducible regeneration of large numbers of plants from protoplasts are still few and far between.

In fairness, it must be stated that without exception the papers are packed with useful information, especially as regards manipulative techniques. Of the many interesting contributions I should like to single out two dealing with fusion. These are: "The physiology of fusion in isolated higher plant protoplasts as a basis for somatic cell genetics" by H. Koblitz of the GDR and "The biophysics of protoplast fusion" by D. F. Gerson *et al.* of Switzerland. The first-mentioned paper considers the problem from a biochemical viewpoint; the second uses surface physics to predict the degree of success that can be expected from cell fusion media.

Each paper has its own bibliography, but the editors have provided indices of subject, organisms and authors which make the volume eminently suitable as a ref ence work. Other than a loss of clarity of photographs resulting from the reproduction of the authors' typescripts in their original forms, the variation in style from paper to paper does not distract. This book is an essential acquisition for those carrying out or contemplating protoplast fusion.

C. H. BORNMAN

ADVANCES IN BIOCHEMICAL ENGINEERING. PLANT CELL CULTURES I, edited by A. Fiechter, with pp. 148. ISBN 3–540–09807–0. Berlin, Heidelberg, New York: Springer-Verlag, 1980.

Volume 16 in the series *Advances in Biochemical Engineering* is on *Plant Cell Cultures,* Part I. It consists of five chapters, all except one dealing with plant cell cultures. Chapter one (G. Wilson of Dublin) compares continuous with batch culture methods of plant cell growth. The application of continuous culture methods to higher plant cells is rather new and the author describes how the design of a chemostat (or phytostat) is influenced by the morphological characteristics and growth responses peculiar to the higher plant cell (as compared with micro-organisms). Chemostat culture is shown to have the advantage over batch culture in allowing differences between effects of growth rate and those of growth-limiting substrate to identify more precisely the factors influencing cell composition and metabolism. This is a well-written chapter with theoretical and practical information on the principles and problems which apply to plant cells that are forced to behave as micro-organisms.

E. Reinhard and A. W. Alfermann (Tübingen, GFR) take up in the third chapter a subject with which they are intimately familiar, namely biotransformation by cell cultures. A large number of biotransformation patterns are reviewed, but by using cardiac glycosides as example they demonstrate that it is the particular strain of cell used that determines the pattern of biotransformation products obtained. Practical applications are also discussed.

The fourth chapter (S. J. Stohs, Nebraska, USA) describes the current knowledge regarding steroid metabolism, repeats (in less detail) Reinhard's and Alfermann's observations on cardiac glycosides, and finally purports to show that plant cell suspension cultures can effect a wide range of steroidal transformation reactions.

In the book's final contribution (S. S. Radwin and H. K. Mangold, Münster, GFR) the advantages of cell culture techniques in basic and applied lipid research are discussed. An interesting observation is that some unusual fatty acids (eg. erucic acid in *Brassica napus*) that occur in the lipids of intact plants are either present at much lower levels in heterotrophic cell cultures or not present at all.

A contribution which in one form or another has been published before, in its own right is a good mini-review of the subject, but does not belong in this volume on cells and secondary products, is that on embryogenesis in *Citrus* tissue cultures by J. Spiegel-Roy and J. Kochba (Israel). It is a pity, since it sounds a false note and effectively reduces an already expensive book from 148 to a bare 126 pages. It is with regret that I make this remark, since it concerns one of the last papers by an esteemed colleague and friend, Dr. Jehoshua Kochba. His untimely death last year robbed Israel and tissue culture of an indefatigable and good-natured worker.

C. H. BORNMAN

PLANT TISSUE CULTURE AS A SOURCE OF BIOCHEMICALS, edited by E. J. Staba, with pp. 285. ISBN 0–8493–5557–5. Boca Raton, Florida: CRC Press, 1980. US $79.85.

When used in cell suspension cultures, there are many difficulties in getting higher plant cells to behave like single-celled bacteria and fungi: they grow slowly and tend to aggregate, produce low concentrations of products, often do not synthesize the desired substances, sometimes produce novel compounds, and frequently are unstable. E. J. Staba of the College of Pharmacy, University of Minnesota is editor of a book on secondary metabolites either produced or transformed by plant cells cultured *in vitro*, and since interest in the biotechnological application of cultured higher plant cells has greatly increased during the past decade, one is inquisitive to know what insights this publication offers.

The book, unfortunately, is composed of a rather motley assortment of 10 chapters, only five of which are more or less directly related to secondary products. Chapter 1 on laboratory culture (J. E. A. Seabrook) properly belongs in a first-year laboratory course manual; Chapters 2 and 5, respectively on nutrition and metabolism and storage of plant cell lines (D. K. Dougall of the W. Alton Jones Cell Science Center), while informative and highly relevant to tissue culture, have very little direct bearing on the book's title. Chapter 6A (M. Seibert and P. G. Kadkade) considers the effects of a much-neglected environmental factor on cultured tissues, namely that of light, but only two pages are devoted to its influence on secondary products. Chapter 6B (S. M. Martin) on the effects of temperature, aeration and pH, makes up 2 % of the book. Chapter 9 (W. E. Goldstein, M. B. Ingle and L. Lasure) is on product cost analysis and is, I am sure, based not on experience with higher plants but on that with micro-organism fermentation. Seen in conjunction with the problems encountered when transferring fermentation technology to higher plant cells, the costs, without doubt, are unrealistically low.

What, then, remains of the book? Five chapters, of which three (Chapter 3 on secondary metabolism and biotransformation—E. J. Staba; Chapter 4 on selection of plant cell lines which accumulate compounds—J. M. Widholm; Chapter 10 on products—L. G. Nickell) are by researchers with extensive experience of secondary plant metabolites produced by cultures *in vitro*. The remaining two chapters (Chapter 7 on mass culture systems for plant cell suspension—S. M. Martin; Chapter 8 on industrial and government research—M. Misawa) deal with technical aspects and practical applications of mass cell culture.

Chapters 3, 4 and 10 supply interesting biochemical and physiological data on the great variety of known secondary products, including alkaloids, antitumour agents, cardiac glycosides, immunochemicals, medicinals, sweeteners, vitamins, etc. They touch on an aspect that in some cases may be even more important than the production of a secondary product, namely the biotransformation by cultured cells of one compound to another (e.g. β-methyldigitoxin to β-methyldigoxin by *Ruta graveolens*). Chapter 8 provides some insight into what is happening at the industrial level, particularly in Japan where, among other products, suspension culture techniques are being used for the production of tobacco cells as a raw material for cigarettes. It seems obvious that there must be many commercial companies with pharmaceutical interests also in Europe and in the US where practical advantage of tissue culture is being taken for industrial application, but where for commercial reasons little is disclosed about specific production processes. This book will have specialist appeal, particularly for those biochemists, natural products chemists and plant physiologists working with secondary product metabolism. Overall, however, the impression is left of a padded, hastily-edited and poorly-integrated work.

C. H. BORNM

PLANT TISSUE CULTURE. Proceedings of the Beijing (Peking) Sino-Australian Symposium on Plant Tissue Culture, with pp. 531. ISBN 0–273–08488–7. Boston, London, Melbourne: Pitman Advanced Publishing Program, 1981. US $45.00.

This book represents in part the proceedings of a symposium held in Peking in May 1978 under the auspices of Academia Sinica and the Australian Academy of Science. Agricultural research in China is mainly focused on essential cereal and vegetable crops and this is reflected in the contributions to the symposium by the Chinese scientists. As regards cereals and vegetables, the major emphasis is on the production of haploid plants via anther culture, with a view to obtaining homozygous lines from F_1 hybrids. According to an Australian scientist who attended the symposium, there were some 700 anther culture stations in China in 1978.

A limited number of volumes of the proceedings were made available by Academia Sinica after the symposium but, perhaps for reasons of distribution and publicity, Pitman Publishing Ltd. has now added a hard cover and is responsible for sales. The contents of the proceedings are organised into three sections, those dealing with anther culture, protoplast culture and somatic hybridization, and vegetative propagation. As might be expected, the translations from Chinese into English are not always smooth. However, this is a minor discomfort when compared to the advantages of being given an insight into the state of tissue culture technology in China. There are of course, for those who do not tire of overexposure, the usual contributions by the Cockings, the Gamborgs and the Melchers.

A fact that stimulated anther culture in China was the use of a potato-based medium. A crude extract is prepared by boiling potato tubers and this is used as a substitute for the macro- and micronutrient elements of the well-known and much-used Murashige & Skoog medium. With the addition of hormones and a sugar source, the potato medium improves the ratio of green to albino plantlets produced from cereal anthers. However, today many scientists are using C. C. Chu's N_6 medium augmented with 2,4–D, kinetin, casein hydrolysate, yeast extract and sucrose. The N_6 medium's major feature is its low concentration of NH_4+ ions.

This book can be recommended for any tissue culture laboratory. Many of its 80 papers serve as a reminder of what can be achieved in plant breeding with simple, inexpensive equipment and media, but combined, in the case of China, with manpower and enthusiasm.

C. H. BORNMAN

CLONING AGRICULTURAL PLANTS VIA IN VITRO TECHNIQUES, edited by B. V. Conger, with pp. 273. ISBN 0–8493–5797–7. Boca Raton, Florida: CRC Press, 1981. US $72.95.

The Chemical Rubber Company Press Inc. of Boca Raton, Florida, USA has in recent years published a number of books with botanical themes, some of which, in my opinion, rate as very good and some less so. The book in question is an excellent one, despite its somewhat misleading title, lack of uniformity of approach between the five contributors, and duplication.

As far as the title is concerned, issue can be taken with two words: cloning and agriculture. *Clone* appears to have lost some of its original meaning, namely that of a population of individuals descended by mitotic division from a single ancestor.

It is currently loosely applied by molecular biologists to describe recombinant DNA procedures as well as by those tissue culturalists who believe that all plants derived via *in vitro* techniques are clonally identical. As far as *agriculture* is concerned it is probably only in the broadest sense that one could regard orchids, ferns, *Haworthia, Pharbitis*, the Cactaceae, and many others as agricultural plants.

The five contributing authors are each responsible for a chapter; the chapters deal with the broad spectrum of ornamentals, fruit crops, vegetable crops, agronomic crops and trees. In the Preface, the editor gives a brief motivation for the book and points out here that no attempt was made to impose uniformity in either style or approach. This quickly becomes very obvious when reading the chapters and finding duplication of principles and procedures as these relate to media, and techniques such as selection of material, surface-sterilization, explanting and subculturing. Even plants (*Citrus, Coffea, Vitis* and others) and references are duplicated. The Introduction (by the editor, B. V. Conger) gives in a nutshell the highlights of plant tissue culture and points to several potential practical applications of this tool in agriculture. Of the latter, the book deals mostly with the aspect of vegetative micropropagation.

All five chapters are informative and very well written, and most of the relevant literature up to the time of submission appears to have been included. The contribution on fruit crops by R. M. Skirvin deserves a special mention. It includes an extensive list of those fruit crops that have been grown in tissue culture, together with the explant sources, the differentiation responses observed, the media, plant growth substances and energy sources used, and the references. In addition, the media are coded to separate tables in which details of macro- and micronutrients and vitamins are given. The reference list is exhaustive and is the only one of the chapters arranged in alphabetical sequence. As regards the type of differentiation encountered, the author indicates whether this consists of callus, adventitious buds, axillary buds, embryoids, roots, as the case may be. Included is also "growth (in a normal manner)" and this I take to mean whole plant regeneration. It is interesting, then, that when one scrutinizes the more than 500 entries it appears that in only about 8 % of cases has this been achieved. Yet Skirvin, in a concluding remark, remains positive: "There appears to be no fruit crop that cannot be grown in tissue culture provided the researcher has sufficient patience and resources."

This is a book in which a wealth of valuable information is locked, from background to problems, from technology to future prospects. However, retrieving this information will require considerable cross-chapter referral. As a source of references this book is well worth the investment.

C. H. Bornman